

# Technical News Bulletin

of the

## National Bureau of Standards

★ Issued Monthly ★

Washington

DECEMBER 1942<sup>1</sup>

Number 308

### CONTENTS

Rubber laboratory in Brazil.	Oxygen requirements at high altitudes.
Densities of synthetic rubbers.	Testing Gelger-Müller counters.
Combination of wool with acids in mixtures.	New and revised publications issued during November 1942.
Phase-equilibrium studies involving potash compounds of portland cement.	Recent articles by members of the Bureau's staff published in outside journals.
High-early-strength cement concretes.	Index to Technical News Bulletin 1942, Numbers 297 to 308, inclusive.
Recommended building code requirements for new dwelling construction.	
Substitutes for metals in heating ducts.	

### RUBBER LABORATORY IN BRAZIL

In an effort to develop its natural resources to the highest point, the Government of Brazil is establishing several regional agricultural institutes; one of these is located at Belem, Para. Through the State Department, the Bureau was requested to assist the Brazilian Government in equipping this laboratory and developing a research program.

Under a provision of an Act of Congress, which provides for the loan of technical experts to South and Central American countries, Norman Bekkedahl, of the Bureau's rubber section, has gone to Belem, where he will serve as chief of the Rubber Technology Division of the Instituto Agronomico do Norte. He has, as his assistant, Fred L. Downs, formerly rubber research chemist on the staff of the American Steel & Wire Co. Before leaving the United States, Dr. Bekkedahl placed orders for the equipment needed to set up a modern rubber research and testing laboratory. When completed, it will be the only one of its kind serving the United Nations in the tropics and at the source of the rubber supply.

Dr. Bekkedahl is well qualified for this important post. He has done a great deal of work on the physicochemical and thermodynamic properties of

rubber, as described in previous numbers of this Bulletin. In 1938 he was appointed by the President to act as delegate for the United States at the Tenth International Congress of Chemistry, at Rome. He served as delegate of the National Academy of Sciences at the same conference and at the Thirteenth Conference of the International Union of Chemistry. He represented the Bureau at the International Rubber Technology Conference in London.

Mr. Downs served as a student assistant in the Bureau's rubber section and as chemist with the Thermoid Rubber Co., where he became familiar with testing and control work. In 1935 he joined the staff of the electrical cable division of the American Steel & Wire Co., and was concerned with the development and testing of rubber insulation. He has had wide experience in the handling of synthetic rubbers and plastic materials.

### DENSITIES OF SYNTHETIC RUBBERS

Synthetic rubber can be produced under conditions which are much better known and more subject to control than those involved in the production of natural rubber. It is logical, then, to measure its density with greater precision, in the hope of being able to ascribe significance to the variations found

<sup>1</sup> Published with approval of the Director of the Budget.

when one sample is compared with another. The densities of different samples of natural rubber show variations as great as 1 or 2 percent, and have never been correlated with the origin or subsequent treatment of the rubber.

The precise measurement of densities of synthetic rubbers forms the subject of a paper by Lawrence A. Wood, Norman Bekkedahl, and Frank L. Roth in the November number of Industrial and Engineering Chemistry, and which will also appear as RP1507 in the December Journal of Research. The paper gives the method of preparing specimens in suitable form, the details of the actual measurements by the method of hydrostatic weighings, and the results obtained for 18 varieties of synthetic rubber, including almost all of those now manufactured in the United States.

Samples of synthetic rubbers as received from the manufacturer were never found to be in a form suitable for precise measurements of the density. Even where there appeared to be no entrapped air and the surface seemed to be relatively smooth, molding produced specimens yielding higher and much more consistent values. A vacuum chamber was designed so that the specimen could be heated and molded under vacuum into a sheet about  $\frac{1}{8}$  inch thick. The density of specimens weighing about 1 gram each, which had been cut from this sheet, was determined. The values obtained with different specimens from the same sample rarely differed from each other by more than 0.05 percent. The measurements were made soon after molding, because some rubbers recover and develop roughened surfaces and vacuoles which bring about a decrease in the apparent density.

Unvulcanized Buna S, prepared in a laboratory polymerization with a minimum quantity of materials other than butadiene and styrene, was found to have a density at 25° C of 0.9291 g/cm<sup>3</sup>. Corresponding values for butadiene-styrene copolymers produced on a commercial scale were as follows: Firestone Buna S, 0.9358; U. S. Rubber Co. Buna S, 0.9369; Standard Oil (N. J.) Buna S, 0.9390; Chemigum IV, 0.9391; Hycar O. S.-20, 0.9385; and Hycar O. S.-30, 0.9303 g/cm<sup>3</sup>. The densities of other common varieties of synthetic rubber were found to be as follows: Neoprene CG, 1.2307; Neoprene E, 1.2384; Neoprene FR, 1.1406; Neoprene GN, 1.2290; Chemigum I, 1.0135; Hycar O. R., 0.9992; Perbunan, 0.9684; Thiokol RD, 1.0564; Thiokol A, 1.5983; Thiokol FA, 1.3298; and Butyl B-1.45, 0.9175 g/cm<sup>3</sup>.

### COMBINATION OF WOOL WITH ACIDS IN MIXTURES

A theory of dyeing should explain the nature of the attraction of dyes for textile fibers, how the dyes go on, and what makes them stick so that they resist washing. It should also aid in understanding the effect on the transfer of the dye from bath to fibers of such factors as the amounts of each acid, dye, and salt present in a complicated solution, the dyebath.

Papers already published have provided a basis for such a theory by demonstrating that different strong acids, including acid dyes, combine with wool to very different extents. These differences have been interpreted in terms of the combination of wool with the anions of acids as well as with hydrogen ions, the combination with each anion being governed by its own distinct and characteristic affinity. In Research Papers RP1510 and RP1511 in the December number of the Journal of Research, Jacinto Steinhardt, Charles N. Fugitt, and Milton Harris, Research Associates of the Textile Foundation, extend this analysis on the basis of measurements of the amounts of each of two acids which combine with wool when a dye acid or salt and various second acids are present in mixtures. It is shown that the two anions compete with each other for combination with the fibers, so that the amounts of each combined depend not only on the amounts initially present but on their respective affinities for wool, as previously determined.

The bearing of these results on the theory of acid dyeing is discussed, with special reference to the factors promoting the attainment of level and solid application of dye to the fibers.

### PHASE-EQUILIBRIUM STUDIES INVOLVING POTASH COMPOUNDS OF PORTLAND CEMENT

In the December Journal of Research (RP1512), William C. Taylor describes an investigational program designed to determine the manner in which K<sub>2</sub>O is combined in portland cement clinker. In general, this involves a series of phase-equilibrium studies of binary and ternary systems. The systems to be included are chosen, from time to time, by examining the products of reaction between a known clinker compound and newly established compound in a system just studied. Specifically, the research on K<sub>2</sub>O in clinker has been conducted as follows: The compound K<sub>2</sub>OAl<sub>2</sub>O<sub>5</sub> was shown to exist in the sys-

tem  $K_2O-CaO-Al_2O_3$ ; following studies showed that  $K_2O-Al_2O_3$  and  $4CaO-Al_2O_3-Fe_2O_3$  form a simple binary system with no additional compound; in ensuing studies, however, it was found that  $K_2O-Al_2O_3$  reacts with  $3CaO-SiO_2$  and with  $2CaO-SiO_2$  in the formation of a ternary potash-lime-silica compound; the composition of this potash-lime-silica compound was established as  $K_2O-0.23CaO-12SiO_2$  by a study of the system  $K_2O-CaO-SiO_2-2CaO-SiO_2$ ; this compound was shown to be stable in the presence of  $3CaO-Al_2O_3$  and  $4CaO-Al_2O_3-Fe_2O_3$ ; the present study of the system  $K_2O-0.23CaO-12SiO_2-CaO-5CaO-3Al_2O_3$  was then undertaken to determine if any other potash compound might exist in clinkers composed of  $K_2O$ ,  $CaO$ ,  $Al_2O_3$ , and  $SiO_2$ , and comparable to portland cement clinker in composition.

The ternary system  $K_2O-0.23CaO-12SiO_2-CaO-5CaO-3Al_2O_3$  was investigated and a phase diagram constructed. The only solid phase, other than the components observed in the system, was the compound  $3CaO-Al_2O_3$ .

Studies of the products of reaction between  $K_2O-0.23CaO-12SiO_2$  and  $CaSO_4$ , and also of those produced when clinker raw mixtures containing both  $K_2O$  and  $SO_3$  are heated, showed that  $K_2O$  combines preferentially with  $SO_3$  to form  $K_2SO_4$ . It was found that any  $K_2O$  in excess of the amount required by the  $SO_3$  in the formation of  $K_2SO_4$ , combines with  $CaO$  and  $SiO_2$  to form  $K_2O-0.23CaO-12SiO_2$ . No evidence was obtained of any potash compounds other than  $K_2SO_4$  and  $K_2O-0.23CaO-12SiO_2$  in clinkers composed of  $K_2O$ ,  $CaO$ ,  $Al_2O_3$ ,  $Fe_2O_3$ ,  $SiO_2$ , and  $SO_3$ .

At elevated temperatures, the molten  $K_2SO_4$  appeared to be immiscible with the other liquid phase formed from the components of the clinker and, consequently, seemed to have no effect on the products of crystallization. Upon cooling,  $K_2SO_4$  crystallized extremely rapidly.

Crystals of  $K_2SO_4$  were identified in several commercial portland cement clinkers.

No reaction of either  $K_2SO_4$  or  $K_2O-0.23CaO-12SiO_2$  with  $MgO$  was observed, which indicates that the presence of  $MgO$  does not affect the manner in which  $K_2O$  is combined in clinker.

#### HIGH-EARLY-STRENGTH CEMENT CONCRETES

Ten-year compressive-strength tests have now been completed on concretes made with 12 high-early-strength cements, for which the results up to 1

year were given in J. Research NBS 14, 723 (June 1935) RP799. The concretes were of three different cement-water (C/W) ratios, five initial temperature conditions, and four curing conditions.

As reported by L. Schuman in the December Journal of Research (RP-1508), concretes stored in damp air generally continued to gain strength up to 10 years. Concretes stored in the air of the laboratory had about the same strengths at 10 years as at 28 days. The strengths at ages after 28 days were not appreciably affected by the initial temperatures, which varied from  $70^{\circ}$  to  $110^{\circ}$  F. However, the usual variation in strength with C/W ratio persisted up to 10 years. For damp-cured 1:2:4 concrete of C/W ratio = 1.50 (7.5 gal of water per 94 lb bag of cement) the compressive strengths at 10 years were generally between 4,000 and 5,000 lb/in.<sup>2</sup> For concrete of the same proportions, and a C/W ratio of 1.73 (6.5 gal per bag), strengths of over 6,000 lb/in.<sup>2</sup> were attained for 8 of the 12 cements.

Present-day cements, even of the moderate-heat type, are shown to be capable of giving concrete strengths in 1 month at least equal to those for a 1910 cement at 10 years; present-day (1941) high-early-strength cements may give strengths at 1 month exceeding the 10-year strengths reported in Research Paper RP1508.

#### RECOMMENDED BUILDING CODE REQUIREMENTS FOR NEW DWELLING CONSTRUCTION

In a report entitled "Recommended Building Code Requirements for New Dwelling Construction With Special Reference to War Housing," just issued in the Building Materials and Structures series, a representative committee drawn from the Federal agencies most concerned with housing, presents its recommendations for improved requirements.

Building code requirements are frequently criticized on the ground that they call for excessive amounts of materials and discourage the introduction of new methods of construction. Such criticism is pointless unless improved requirements can be offered that will have the effect of correcting the conditions mentioned.

Building code requirements can be legally effective only when they call for the minimum that is necessary for safety and health. This places such requirements in a different class from other standards, which properly take

into consideration expected life, comfort, livability, good taste, and other matters that are socially and economically desirable but cannot be legally required. An appreciation of this distinction should help to clear up some of the confusion that exists regarding apparent inconsistencies between building standards and building code requirements.

The recommended requirements contained in the report apply to single- and two-family houses and to multiple dwellings of limited height, and cover such matters as fire resistance, light and ventilation, exits, strength of construction, and chimneys and fireplaces. In general, good practice is required, certain well-recognized standards and specifications being cited as acceptable evidence that this is being followed. Specific dimensions and other details are given where necessary. The intent is to assure safety and health, and at the same time to permit the greatest possible flexibility in design and construction.

The committee recognizes that emergency conditions limit the availability of certain materials, require stringent economy in the use of others, and make the use of substitutes necessary in some cases. However, the committee has not considered it practicable to write building code requirements in terms of a severely restricted list of materials based on temporary shortages or to suggest details about substitutes in the code itself. Such matters are covered more flexibly and efficiently by general code provisions, supplemented by regulations that can be put into effect or withdrawn in accordance with fluctuating conditions. The subjects of new materials and methods of construction are treated in a general way, providing for their acceptance on submittal of satisfactory evidence that they are suitable. In order to conserve space in the code itself and to widen the field of choice of materials and methods, the report contains an appendix giving information on various acceptable ways of meeting specific code requirements and references to source material.

The report, which is designated as BMS88, is recommended to those seeking the advice of Federal agencies as to proper building code requirements in areas not now having such requirements. It is also offered for consideration wherever local building codes are being adopted or revised. It is believed that such a document can provide a continuing service through which the experience of Federal agencies and the

results of Federal research can be made continuously available to local governmental authorities. Periodical revision is planned, and criticism and suggestions for improvement are invited. Copies of the report are obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C. The price is 20 cents.

#### SUBSTITUTES FOR METAL IN HEATING DUCTS

Restrictions against the use of metal, particularly galvanized and tinned sheets, make necessary the use of substitutes. Unfortunately, no other readily available material has the same characteristics from the viewpoint of the sheet-metal worker. A number of fire tests with proposed substitutes have been recently conducted at the Bureau.

A substitute that can be worked with the same tools and technique would find more ready acceptance by the trade, because any changes required in the procedure of fabrication and erection will usually work a hardship by slowing up the job. For these reasons the thin, pliable sheets have found favor, although some of the rigid boards may have superior structural strength and durability. Since fire safety requirements are lower for returns than for the hot-air ducts, different materials for the two kinds of ducts are used in many installations.

Among the pliable boards offered are several composed of a felt base with high melting point asphalt saturant and coating. Others are of similar composition for the core with facings of asbestos paper. These are combustible. Other pliable boards have paper boxboard or pressboard cores with asbestos paper facings. Some of these are rated "Combustible" or "Slow-burning", and others "Fire Retardant", as tested according to the procedure outlined in Federal Specification SS-A-118 for prefabricated acoustical units, to which reference is made for testing methods and classification requirements. The incorporation of bituminous materials to lower absorption will usually increase flammability. Fire retardant treatment of pressboard or boxboard cores makes for increased safety from flame spread.

Cement-asbestos boards have many characteristics that make them suitable for duct walls, although they are not readily worked into turns, branches, and other complicated fittings. In one system of fabrication, the edges of the board are mitered and cemented together with an adhesive, after which paper tape is

applied to bind the corners on the outside. Another system employs grooved strips of flameproofed wood for corner members, and a third employs metal corner strips. All of these require some metal for fittings and unusual conditions.

A substitute for galvanized metal suitable for ducts or duct fittings recently placed on the market consists of pickled iron sheets coated with a high-melting-point compound of fatty acid pitch containing a high percentage of inert mineral filler.

This coating is covered with mica dust, which gives the sheet a gray color and a greasy feel. The technique and tools for working this material are the same as for galvanized metal except that preparation for soldering requires the removal of the coating from the areas to be joined. It is probable that this material will be acceptable to sheet-metal workers for use in lieu of the galvanized steel usually employed. The tests have indicated that only materials classed as "Incombustible" or "Fire Retardant" should be used for hot-air-supply ducts, with those of the latter classification at not less than 6 feet from the heating plant if liquid or solid fuels are employed. Material for return ducts may be of lower classification with respect to fire safety, but combustible materials should not be used within 3 feet of the heating plants.

#### OXYGEN REQUIREMENTS AT HIGH ALTITUDES

Normal persons become markedly less efficient at altitudes of 10,000 to 15,000 feet and collapse at around 20,000 feet when breathing air, but when breathing supplemental oxygen, they can ascend to much greater altitudes without danger of collapse.

In an article by W. A. Wildhack in the December number of the Journal of the Aeronautical Sciences, theoretical equations are developed to determine what concentrations of oxygen must be breathed at any altitude to maintain the "oxygen equivalent" of air at selected altitudes—i. e., the same alveolar oxygen pressure. The partial pressures of water vapor and carbon dioxide are taken into account, as well as the variation of the pressure of carbon dioxide with the alveolar oxygen pressure.

Six curves are given on a chart showing the oxygen concentrations required at any altitude to maintain the oxygen equivalent of air at sea level, and at altitudes of 5, 10, 15, 20, and 25 thou-

sand feet. Altitudes of 33, 40, and 46 thousands feet with pure oxygen are equivalent to air at sea level, 10, and 20 thousand feet, respectively.

It is shown that these equivalents are nearly independent of the assumptions as to the state of physiological adaptation, and should be applicable to all individuals.

#### TESTING GEIGER-MÜLLER COUNTERS

The Geiger-Müller counter is one of the most sensitive devices now available to physicists for detecting radiation from radioactive materials. It is also used extensively in the study of cosmic rays. Up to the present time it has been customary for individual scientists to prepare their own Geiger-Müller counters. This has led to a great variety of methods of manufacture, each claimed to be superior to the other. However, but little opportunity has existed for actual comparisons.

Few methods have been available to test the performance of these tube counters, but in RP1509 in the Journal of Research for December, F. J. Davis and L. F. Curtiss describe such a testing instrument. This determines quite accurately whether the pulses from a tube counter correspond in separation to that expected when the counter is exposed to a source of radiation (radioactive substance) which emits rays distributed in time according to the laws of probability. This instrument is called an "interval selector," since it records the number of intervals between pulses less than some chosen interval. The chosen interval may be varied between 0.0001 and 0.2 second. In addition, the instrument records the total number of pulses, so that the expected number under any set of conditions may be computed mathematically. If the observed number of pulses in the chosen interval agrees with the computed number, the counter satisfies one requirement for proper operation. It is then safe to assume that no spurious pulses (pulses not resulting from the radiation) are generated by the counter itself.

The authors have used this newly developed instrument to study the behavior of Geiger-Müller tube counters filled with a mixture of alcohol vapor and argon gas, as well as amyl acetate vapor and argon gas. They have found that this type of counter will give a time response to the radiation if fairly simple directions are followed in its preparation; moreover, some of the difficulties which have been reported in pre-

paring this type of counter have now been removed. Since the vapor type of counter requires a very simple vacuum-tube amplifier for operation (when compared with counter tubes using permanent gases alone) it is to be expected that these simplified manufacturing and testing procedures will result in its wider use.

It is now possible, in the opinion of the authors, to prepare Geiger-Müller counters of the alcohol-argon type that can be calibrated in the same manner as any other instrument. By the use of such calibrated counters, measurements in different laboratories may be compared quantitatively. This has not been possible in many instances heretofore. The authors have counters of the vapor type which have been in use for over 2 years with no essential changes of characteristics. It is evident, therefore, that the vapor type of counter is reasonably permanent when properly prepared.

#### NEW AND REVISED PUBLICATIONS ISSUED DURING NOVEMBER 1942

##### Journal of Research<sup>2</sup>

Journal of Research of the National Bureau of Standards, volume 29, number 5, November 1942 (P1502 to RP1506, inclusive). Price 30 cents. Annual subscription, 12 issues, \$3.50.

##### Building Materials and Structures Reports<sup>3</sup>

[Persons who wish to be notified of new publications in the Building Materials and Structures series as soon as they are available should write to the Superintendent of Doc-

<sup>2</sup> Send orders for publications under this heading only to the Superintendent of Documents, Government Printing Office, Washington, D. C. Subscription to Technical News Bulletin, 50 cents a year; Journal of Research, \$3.50 a year (to addresses in the United States and its possessions and to countries extending the franking privilege; other countries, 70 cents and \$4.50, respectively).

uments, Government Printing Office, Washington, D. C., asking that their names be placed on the special mailing list maintained by him for this purpose.]

BMS88. Recommended building code requirements for new dwelling construction with special reference to war housing. Report of Subcommittee on Building Codes, Central Housing Committee on Research, Design, and Construction. Price 20 cents.

##### Simplified Practice Recommendation<sup>2</sup>

R179-42. Structural insulating board (vegetable fiber). (Supersedes R179-41). Price 5 cents.

##### Technical News Bulletin<sup>3</sup>

Technical News Bulletin 307, November 1942. Price 5 cents. Annual subscription, 50 cents.

#### RECENT ARTICLES BY MEMBERS OF THE BUREAU'S STAFF PUBLISHED IN OUTSIDE JOURNALS<sup>3</sup>

Method for analyzing the gasoline fraction of petroleum, with preliminary results on East Texas and Oklahoma crudes. Frederick D. Rossini, Beveridge J. Mair, Alphonse F. Forzati, Augustus R. Glasgow, Jr. and Charles B. Willingham. Preprint of paper before 23rd annual meeting, Am. Petroleum Institute (50 West 50th St., New York, N. Y.) (November 10, 1942).

Plastics, Gordon M. Kline. Annual report, Smithsonian Institution (Washington, D. C.), p. 225 (October 1941). Factors influencing austenitic grain size. T. G. Digges and S. J. Rosenberg. Metal Progress (7301 Euclid Ave., Cleveland, Ohio) 42, 608 (October 1942).

<sup>3</sup> These publications (unless otherwise stated) are not obtainable from the Government. Requests should be sent direct to the publishers.

**INDEX TO TECHNICAL NEWS BULETIN 1942, NUMBERS 297 TO 308,  
INCLUSIVE**

<b>A</b>	<b>Page</b>	<b>Page</b>	
Abbe-type refractometers, testing and accurate use	76	Building, the, as a defense against incendiary bombs	83
Acid titration data, calculation of protein-anion affinity constants	76	Buildings, water-distributing systems in	4
Acidity and alkalinity of aqueous solutions, provisional standards	76	C	
Acids, aldonic, lower, preparation	76	Calcium carbonate in rubber	20
Acids, combination with wool in mixtures	76	Calcium chloride, effect on concrete	86
Acrylic resins for dentures	76	Carbohydrate chemistry, use of polariscope	75
Adsorbents, bone black and other surface	76	Carbon and hydrogen, determination in bone black and other chars	44
Aging, accelerated, of lace leathers	76	Carpets, wear tests	86
Air permeability of fabrics	76	Catalyzed hydrolysis of proteins	85
Air raid warning devices	76	Cathodic protection of pipe lines	4
Air raids, protection of radium during	76	Cellulose acetate, fractionation	61
Airplane-camera lenses, wide angle	76	Cellulose and magnesium, self-ignition temperatures	78
Aldonic acids, lower, preparation	76	Cellulose, oxidation	61
Altitude, effect on knock rating	76	Cement-concretes, high-early-strength	93
Altitudes, high oxygen requirements	76	Cement, portland, potash compounds in	92
Altitudes, various, knock rating tests	76	Certification plan	67
Ampere, absolute determination	76	Chairs, folding, for school use	12
Anions of strong acids, affinities for wool	76	Chalks, simplified practice recommendation	57
Anomaly, the beta, in rubber	76	Chars and bone black, determination of carbon and hydrogen in	44
Antimony, the first spectrum	76	Check list, field inspector's, for building construction	55
Austenite, formation in an iron-carbon alloy	76	Clay products, structural, low-cost glazes	37
Austenitic grain size in steels	76	Clays, modeling, simplified practice recommendation	57*
Automobiles, dead storage	76	Coatings for protecting metals from soil corrosion	4
Award of "E" pennant to Bureau by Navy	76	Code, building, local, preparing	13
Axes, forged, simplified practice recommendation	13, 87	Code requirements, recommended building, for dwelling construction	93
<b>B</b>			
Bars, steel reinforcing, simplified practice recommendation	56	Cold-worked surface layers, thickness	62
Batteries and dry cells, specification	56	Color, photoelectric measurement	76
Beater practice in manufacture of offset papers	31	Columns, steel, perforated cover plates for	43
Belting leather, methods of testing	5	Commercial standard for artists' oil paints	36
Benzolic acid, heat of combustion	77	Commercial standard for clinical thermometers	68
Bombs, incendiary, the building as a defense against	83	Commercial standard for driving and passing lamps	21
Bombs, incendiary, light from, protection of eyes	26	Commercial standard for gas floor furnaces	56
Bombs, incendiary, structural protection against	17	Commercial standard for multiple-coated, porcelain-enamelled, steel utensils	57
Bonding layer of soft-soldered joints	29	Commercial standard for oil-burning space heaters	56
Bone black and other adsorbents, surface	71	Commercial standard for staple vitreous china plumbing fixtures	68
Bone black, determination of carbon and hydrogen in	44	Concrete, effect of calcium chloride	86
Boxes, fiber, for canned fruits and vegetables, simplified practice recommendation	14	Concrete, paving, compacted by vibration	5
Brazil, rubber laboratory in	91	Concretes, cement, high-early-strength	93
Bricks, freezing and thawing tests	63	Conference of State utilities commission engineers, twentieth annual	49
Broadcast, standard frequency revised	9	Conference, soil corrosion, 1942	22
Building code, local, preparing	13	Constant of gravitation, redetermination	50
Building code requirements, recommended, for dwelling construction	93	Construction requirements, recommended code for dwellings	93
Building construction, field inspector's check list	55	Copper tubing, lead-base soldered joints in	55
Building construction, method for developing specifications	68	Corrosion in soils	45
Building construction, redesign and substitution	13	Corrosion, soil, coatings for protecting metals from	4
		Corrosion, soil, conference, 1942	22

Page	Page		
Corrosion, soil, of pipe lines, cathodic protection.....	4	Grain size, austenitic, in steels.....	51
Corrosion, soil, summary of data.....	54	Gravitation constant, redetermination.....	50
Corrosion studies, soil, 1939.....	22	Gravity, absolute determination, Potsdam, a reexamination.....	84
Cover plates, perforated, for steel columns.....	43		
Coverings, floor, dimensional changes.....	69	H	
Crayons, simplified practice recommendation.....	57	Hahner, C. H., chief of glass section.....	88
Creep rates of monel metal.....	28	Handbook on weights and measures administration.....	1
		Hardness of steel plates.....	52
<b>D</b>		Heat of combustion of benzole acid.....	77
Densities of synthetic rubbers.....	91	Heaters, oil-burning space, commercial standard.....	56
Dental impression materials, shelf life.....	78	Heating ducts, substitutes for metal.....	94
Dental materials, physical properties.....	34	Housing terms, glossary.....	87
Dental resins, curling, substitute for tin foil in.....	62, 78	Hycar O. R. synthetic rubber, specific heat.....	52
Dentures, acrylic resins for.....	1	Hydrolysis, catalyzed, of proteins.....	85
Directory of testing laboratories, revised.....	31		
Dishes or trays, food, simplified practice recommendation.....	35	<b>I</b>	
Dry cells and batteries, specification.....	31	Impression materials, dental, shelf life.....	78
Ducts, heating, substitutes for metal in.....	94	Indigestibility of wool protein.....	77
		Integrals, sine and cosine, tables.....	72
<b>E</b>		Interval selector for random pulses.....	95
"E" pennant, awarded by Navy to Bureau.....		Iron-carbon alloy, formation of austenite in.....	63
Earth-wall constructions.....		Iron, high purity.....	36
Earths, rare, analysis.....		Irons, alloy cast, elastic properties.....	2
Elastic properties of alloy cast irons.....		Isotherms, critical, of pure substances, equation.....	61
Elasticity of wool.....			
Electrical conduction in glass.....		<b>J</b>	
Electrical units, absolute determination of the ampere.....		Jacks, screw, bell-bottom, simplified practice recommendation.....	45
Electricity, static.....			
Emergency alternate specifications.....		<b>K</b>	
Enamel, porcelain, weather resistance.....		Knees of rigid frames, stresses in.....	13
Expansivity of a Vycor brand glass.....		Knock rating, effect of altitudes.....	42
Eyes, protection against light from incendiary bombs.....		Knock rating, motor fuel, precision.....	60
		Knock rating tests at various altitudes.....	6
<b>F</b>			
Fabrics, air permeability.....		<b>L</b>	
Fading rate of paints.....		Laboratories, testing, revised directory.....	31
Fatigue, flexural, of textiles.....		Laboratory, rubber, in Brazil.....	91
Ferrous materials, elimination of oxide films.....		Lamps, driving and passing, commercial standard.....	21
Fibers, textile, characteristics.....		Leather belting, methods of testing.....	5
Finn, Alfred N., death.....		Leathers, lace, accelerated aging.....	54
Firebrick, spalling.....		Lenses, airplane-camera, wide angle.....	70
Fires from bombs, the building as a defense against.....		Light, diffusely incident, Fresnel reflection.....	85
Fixed point, basic, triple point of water (as a)		Logarithms, natural, of the decimal numbers from 5.0000 to 10.0000, tables.....	46
Flannel, cotton canton, for work gloves, simplified practice recommendation.....		Logarithms, natural, 16-place tables.....	14
Flax, microscopic structure.....			
Floor coverings, dimensional changes.....		<b>M</b>	
Floor coverings, performance test, fourth progress report.....		Magnesium and cellulose, self-ignition, temperatures.....	78
Flow-manostat for various purposes.....		Manostat, flow, for various purposes.....	59
Flow of water in open channels.....		Mars, planet, temperature estimates, revised.....	22
Fractionation of cellulose acetate.....		Mathematical tables, moments of inertia and section moduli.....	33
Freezing and thawing tests of bricks.....		Mathematical tables, natural logarithms.....	14, 36
Frequency, standard, revised broadcast light.....		Mathematical tables, probability functions.....	80
Fresnel reflection of diffusely incident light.....		Mathematical tables, sine and cosine integrals.....	72
Frictional properties of rubber.....		Metals, coatings for protection against soil corrosion.....	4
Fuel, motor, precision of testing.....		Metals, nonferrous, oxidation.....	37
Furnaces, gas floor, commercial standard.....		Metals, tensile elastic properties.....	21
		Microscopic structure of flax.....	52
<b>G</b>		Moments of inertia and section moduli, tables.....	88
Gauze, surgical, simplified practice recommendation.....		Monel metal, creep rates.....	28
Geiger-Müller counters, testing.....		Mortars, refractory bonding.....	30
Glass, electrical conduction in.....		Motion-picture projectors, 16-mm, requirements.....	59, 70
Glass volumetric apparatus, testing.....			
Glass, Vycor brand, expansivity.....			
Glazes, low-cost, for structural clay products.....			
Glossary of housing terms.....			
Gloves, work, cotton canton flannel, simplified practice recommendation.....			

N	Page	
Navy awards "E" pennant to Bureau	17	
Nonferrous metals, oxidation	37	
 O		
Organizations, technical and trade, standardization work	18	
Oxidation of cellulose	61	
Oxidation of nonferrous metals	87	
Oxide films on ferrous materials, elimination	36	
Oxygen requirements at high altitudes	95	
 P		
Paints, artists', oil, commercial standard	26	
Paints, fading rate	44	
Papers, offset, beater practice	20	
Parachute opening, optimum time of delay	5	
Paving concrete compacted by vibration	41	
Permeability, air, of fabrics	5	
Permeability, water, of walls built of masonry units	35	
Personnel changes	88	
pH standards, provisional	2	
Phase-equilibrium studies involving the potash compounds of portland cement	61	
"PHC" prefabricated wood-frame construction	79	
Photo-electric measurement of color	76	
Pipe fittings, simplified practice recommendation	30	
Pipe lines, cathodic protection	4	
Plastics, recent developments	25	
Platinum resistance thermometers, intercomparison	10	
Plumbing fixtures, staple vitreous china, commercial standard	68	
Polarimetry, new circular on	75	
Polarographic studies of sugar acids	43	
Porcelain enamel, weather resistance	85	
Porosity, a volumenometer for measuring	92	
Portland cement, potash compounds in	92	
Potash compounds in portland cement	92	
Potsdam absolute determination of gravity, a reexamination	84	
"Precision-built, Jr." prefabricated wood-frame wall construction	69	
Prefabricated wood-frame wall construction, "Precision-built, Jr."	69	
Probability functions, tables	59	
Projectors, motion picture, 16-mm. requirements	59, 70	
Protein-anion affinity constants, calculation from acid titration data	12	
Proteins, catalyzed hydrolysis	85	
Pulses, random, interval selector for	95	
Pure substances, equation for critical isotherms	61	
 R		
Radiation, ultraviolet, in high latitudes	35	
Radio broadcast, standard frequency revised	35	
Radium, protection during air raids	9	
Redesign and substitution in building construction	13	
Reflection, Fresnel, of diffusely incident light	85	
Refractometers, Abbe-type, testing and accurate use	76	
Refractory bonding mortars	13	
Rigid frames, stresses in knees	88	
Roeser, William F., chief of section on mechanical metallurgy	54	
Roofing materials, survey in south central States	20	
Rubber, the beta anomaly in	19	
Rubber, calcium carbonate in	26	
Rubber, evaluation of processes for producing	19	
Rubber, frictional properties	26	
Rubber laboratory in Brazil	91	
 S		
Rubber, synthetic, densities	91	
Rubber, synthetic, Hycar O. R. specific heat	52	
 School furniture, specification for folding chairs		12
Screw-thread standards for Federal services, revised	81	
Section moduli, tables	87	
Self-ignition of cellulose and magnesium	38	
Shovels, spades and scoops, simplified practice recommendation	38	
Signals, air raid warning	78	
Simplified practice recommendation for bell-bottom screw jacks	79	
Simplified practice recommendation for cotton canton flannels for work gloves	35	
Simplified practice recommendation for crayons, chalks, and modeling clays	57	
Simplified practice recommendation for fiber boxes for canned fruits and vegetables	14	
Simplified practice recommendation for food trays or dishes	85	
Simplified practice recommendation for forged axes	13, 87	
Simplified practice recommendation for pipe fittings	30	
Simplified practice recommendation for shovels, spades and scoops	56	
Simplified practice recommendation for steel reinforcing bars	87	
Simplified practice recommendation for stove pipe	56	
Simplified practice recommendation for surgical gauze	87	
Sine and cosine integrals, tables	72	
Smith, W. Harold, chief, section on organic chemistry	88	
Soil-corrosion studies, 1939	22	
Soil corrosion, summary of data	54	
Soils, corrosion in	45	
Soldered joints, lead-base, in copper tubing	55	
Soldered joints, soft, changes in bonding layer	29	
Sound motion picture projectors, 16-mm., performance requirements	70	
Spalling of firebrick	45	
Specific heat of synthetic rubber, Hycar O. R.	52	
Specification for dry cells and batteries	31	
Specifications, emergency alternate	67	
Specifications for building construction, method for developing	68	
Spectrographic analysis of commercial tin	11	
Spectrum, first, of antimony	28	
"Speedbrik" wall construction	69	
Stability of wools enhanced by chemical modification	78	
Standardization work of technical and trade organizations	18	
Standards, pH, provisional	71	
State utilities commission engineers, twentieth annual conference	49	
Static electricity	71	
Steel plates, hardness	52	
Steel sheets, stainless, properties	29	
Steel, welding quality	3	
Steels, austenitic grain size in	51	
Storage, dead, of automobiles	33	
Stove pipe, simplified practice recommendation	56	
Stress, residual, relief of, in streamline tirods	43	
Stresses in knees of rigid frames	13	
Structural properties of "PHC" prefabricated wood-frame construction	79	
Structural protection against incendiary bombs	17	
Sugar acids, polarographic studies	2	
Sugar industry, use of polariscope	75	
Swanger, W. H., death	88	
Synthetic rubbers, densities	91	

	Page		Page
<b>T</b>			
Tables, mathematical, moments of inertia and section moduli	35	Utensils, steel, multiple-coated porcelain enamel, commercial standard	51
Tables, mathematical, natural logarithms	14, 36	Utilities commission engineers, State, twentieth annual conference	49
Tables, mathematical, probability functions	80	<b>V</b>	
Tables, mathematical, sine and cosine integrals	72	Vibration, use of, in compacting concrete	5
Tee-bend test for welding quality of steels	3	Volumenometer, an improved	85
Temperature estimates of the planet Mars, revised	22	Volumetric apparatus, glass, testing	27
Tensile elastic properties of metals	21	Vycor brand glass, expansivity	2
Testing laboratories, revised directory	31	<b>W</b>	
Textile fibers, characteristics	85	Wall construction, prefabricated wood-frame, "Precision-Sault, Jr."	69
Textile Research War Council	42	Wall construction, "Speedbrik"	69
Textiles, flexural fatigue	53	Wall constructions, earth	5
Thermometers, clinical, commercial standard	68	Walls built of masonry units, water permeability	54
Thermometers, platinum resistance, intercomparison	10	Water-distributing systems for buildings	4
Thermometers, resistance, electrical conduction in glass insulation	27	Water flow in open channels	50
Thickness of cold-worked surface layers of metals	62	Water, triple point, as a basic fixed point	71
Thompson Award, Sanford E., presented to John Tucker, Jr.	14	Waters, Campbell E., retirement	88
Thompson, J. G., assistant chief, metallurgy division	88	Wear tests of carpets	36
Threaded parts, Federal standards	11	Weather resistance of porcelain enamel on iron structural units	43
Tierods, streamline, relief of residual stress	78	Weights and measures administration handbook	1
Tin, commercial, spectrographic analysis	43	Welding quality of steel	8
Tinfol, substitute for, in curing dental resins	71	Wichers, Edward, assistant chief, chemistry division	88
Trays or dishes, food, simplified practice recommendation	35	Wide angle airplane-camera lenses	70
Triple point of water as a basic fixed point	71	Wood-frame construction, "PHC" prefabricated	79
Tucker, John, Jr., receives Sanford E. Thompson Award	64	Wool, combination with acids in mixtures	92
<b>U</b>			
Ultraviolet radiation in high latitudes	35	Wool, elasticity	93
Units, masonry, water permeability of walls built of	54	Wool protein, affinities of anions of strong acids for	12
<b>X, Y, Z</b>			
X-ray machines, tests of, for the Government	70	Wools, chemically modified, of enhanced stability	78

Page  
in 57  
e, 49  
--

n-  
-- 5  
-- 85  
-- 27  
-- 2

d-  
-- 69  
-- 69  
-- 5  
er 54  
s- 4  
t- 50  
t- 71  
-- 88  
el 45  
on 18  
-- 18  
n- 88  
-- 70  
re- 79  
x- 92  
-- 53  
of 12  
-- 77  
ed 78  
-- 78

v- 70